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PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 049280-0101	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/IB2004/004419	International filing date *(day/month/year)* 10 December 2004 (10-12-2004)	Priority date *(day/month/year)* 12 December 2003 (12-12-2003)

International Patent Classification (IPC) or national classification and IPC
IPC: ***C12N 15/82*** (2006.01) , ***A01H 5/00*** (2006.01) , ***A01H 3/00*** (2006.01)

Applicant
UNIVERSITY OF MANITOBA ET AL

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. [X] *(sent to the applicant and to the International Bureau)* a total of 3 sheets, as follows:
      [X] sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      [ ] sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. 1 and the Supplemental Box.
   b. [ ] *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:
   - [X] Box No. I Basis of the report
   - [ ] Box No. II Priority
   - [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - [ ] Box No. IV Lack of unity of invention
   - [X] Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - [ ] Box No. VI Certain documents cited
   - [ ] Box No. VII Certain defects in the international application
   - [X] Box No. VIII Certain observations on the international application

Date of submission of the demand 12 October 2005 (12-10-2005)	Date of completion of this report 16 March 2006 (16-03-2006)
Name and mailing address of the IPEA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001(819)953-2476	Authorized officer Robert Rymerson (819) 956-9972

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB2004/004419

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:

[X] the international application in the language in which it was filed

[ ] a translation of the international application into , which is the language of a translation furnished for the purposes of:

[ ] international search (Rules 12.3(a) and 23.1(b))

[ ] publication of the international application (Rule 12.4(a))

[ ] international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

[ ] the international application as originally filed/furnished

[X] the description:

[X] pages 1-24 as originally filed/furnished

[ ] pages* received by this Authority on

[ ] pages* received by this Authority on

[X] the claims:

[ ] pages as originally filed/furnished

[ ] pages* as amended (together with any statement) under Article 19

[X] pages* 25-27 received by this Authority on 12-Oct-2005

[ ] pages* received by this Authority on

[X] the drawings:

[X] pages 1-6 as originally filed/furnished

[ ] pages* received by this Authority on

[ ] pages* received by this Authority on

[ ] a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. [X] The amendments have resulted in the cancellation of:

[ ] the description, pages

[X] the claims, Nos. 1-23 as originally filed

[ ] the drawings, sheets/figs

[ ] the sequence listing *(specify):*

[ ] any table(s) related to sequence listing *(specify):*

4. [ ] This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

[ ] the description, pages

[ ] the claims, Nos.

[ ] the drawings, sheets/figs

[ ] the sequence listing *(specify):*

[ ] any table(s) related to sequence listing *(specify):*

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	3-5, 7-13, 15, 18-21	YES
	Claims	1, 2, 6, 14, 16 and 17	NO
Inventive step (IS)	Claims	3-5, 7-13, 15, 18-21	YES
	Claims	1, 2, 6, 14, 16 and 17	NO
Industrial applicability (IA)	Claims	1-21	YES
	Claims	-	NO

2. Citations and explanations (Rule 70.7)

D1: HUNT PW ET AL. "Increased level of hemoglobin 1 enhances survival of hypoxic stress and promotes early growth in Arabidopsis thaliana." PROC. NATL. ACAD. SCI. USA. 24-Dec-2002 vol. 99 no. 26: 17197-17202
D2: US6372961 B1 PIONEER HI-BRED INTERNATIONAL, INC. (Tarczynski MC and Shen B) 16-Apr-2002

D1 discloses transgenic Arabidopsis thaliana plants overexpressing the GLB1 protein (non-symbiotic plant hemoglobin). These plants showed early vigorous growth under nonhypoxic conditions and were 50% larger than the control plants at 14 days. Roots grew significantly more during the 9 day test and had 40% lower root hair density and 60% more lateral roots compared with the control plants. Also disclosed are methods for making said transgenic Arabidopsis plants.

D2 discloses transgenic maize plants overexpressing a maize non-symbiotic hemoglobin gene and methods for their use. Specifically, the expression of hemoglobin provides a method for enhancing seed germination, seedling growth and overall growth and metabolism of the transformed plant.

Novelty:

In view of D1 or D2, claims 1, 2, 6, 14, 16 and 17 cannot be considered novel and do not comply with Article 33(2) of the PCT.

D1 discloses transgenic plants and methods for making transgenic plants transformed with a non-symbiotic hemoglobin that have a modified phenotype (modified root characteristics, increased growth rate). In the correspondence of 12-Oct-2005, applicant has argued that D1 does not anticipate the claimed alleged invention because a modified plant phenotype is not taught in D1. Applicant further states that the differences in root appearance reported in D1 are not a true modified phenotype, but simply reflect an increased growth rate.

It is pointed out that the commonly accepted meaning of phenotype is "the observable physical or biochemical characteristics of an organism, as determined by both genetic makeup and environmental influences" (The American Heritage® Dictionary of the English Language, Fourth Edition, Copyright 2000 by Houghton Mifflin Company). Therefore, the characteristic of increased growth rate (D1) is properly considered a phenotype because it is an observable characteristic with both genetic and environmental components. Furthermore, it is clear from the claims as filed that the applicant considers growth and yield to be phenotypes (see claim 4 as filed, now deleted).

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Description:

The description does not comply with Article 5 of the PCT. A statement such as found on page 1, lines 5-6, which incorporates by reference any other document does not fully describe the invention. A person skilled in the art should be able to understand the patent specification without reference to any other document.

The description does not comply with Article 5 of the PCT. Furthermore, a statement in an application, such as found on page 1, line 4, which includes a reference to any provisional application, should be removed. The PCT does not provide for any reference to provisional applications.

Claims:

Claims 2 and 3 do not comply with Article 6 of the PCT. The phrase "and combinations thereof" causes a lack of clarity.

Claims 19-21 do not comply with Article 6 of the PCT. There is no substantive support for the subject matter of these claims in the description as filed. There is no demonstration or characterization of a method of modifying a response to a plant hormone using nonsymbiotic hemoglobin in the description as filed.

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: Box V

Applicant has argued that the modifications to root appearance reported in D1 are not considered an altered phenotype because they are a result of increased growth rate. Also, applicant points out that D1 does not indicate that the transformed plants exhibited modified apical dominance or taproot width as recited in the instant claims 1 and 16. However, the phrase "if said phenotype is a root phenotype, said phenotype is selected from the group consisting of apical dominance and taproot width" in claims 1 and 16 is conditional. If the phenotype is not a root, then the methods and transgenic plants disclosed in D1, which exhibit increased growth rate (considered a phenotype as noted above), clearly anticipate claims 1, 2, 6, 14, 16 and 17.

D2 discloses transgenic plants and methods for making transgenic plants transformed with a non-symbiotic hemoglobin that have a modified phenotype (increased seed germination, increased seedling growth and increased overall growth and metabolism). Applicant has argued that D2 does not teach or suggest that modifying the expression level of plant non-symbiotic hemoglobin could result in an altered plant phenotype under normal oxygen conditions and that there is no data in D2 to allow a skilled person to predict or expect such an effect. The US Patent D2 is considered to contain sufficient information for a skilled person to be led easily and directly to the claimed subject matter. It is pointed out that increased seed germination, increased seedling growth and increased overall growth and metabolism are considered phenotypes, because they are observable physical or biochemical characteristics with both genetic and environmental components (see the discussion of D1 above). D2 does not indicate that any special oxygen conditions are required, so the oxygen conditions are considered "normal" by default. As noted above, the phrase "if said phenotype is a root phenotype, said phenotype is selected from the group consisting of apical dominance and taproot width" in claims 1 and 16 is conditional. If the phenotype is not a root, then the methods and transgenic plants indicated in D2, with increased seed germination, increased seedling growth or increased overall growth and metabolism anticipate claims 1, 2, 6, 14, 16 and 17.

In view of the prior art, claims 1, 2, 6, 14, 16 and 17 do not comply with Article 33(2) of the PCT and are not considered novel.

Claims 3-5, 7-13, 15, 18-21 appear to comply with Article 33(2) of the PCT and are considered novel

Inventive Step:
In view of the lack of novelty noted above, claims 1, 2, 6, 14, 16 and 17 also lack an inventive step and do not comply with Article 33(3) of the PCT.

In view of the prior art, claims 3-5, 7-13, 15, 18-21 appear to contain an inventive step and to comply with Article 33(3) of the PCT.

Industrial Applicability:
Claims 1-21 appear to have industrial applicability and to meet the requirements of Article 33(4) of the PCT.